NOTHING RUNS LIKE A (AUTONOMOUS) DEERE: HOW GOVERNMENT-SPONSORED RESKILLING CAN CUSHION THE BLOW OF TECHNOLOGICAL ADVANCEMENT FOR KANSAN FARM WORKERS

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I. INTRODUCTION

Labor in the United States is about to undergo drastic changes.[1] Novel and powerful technologies are likely to automate many jobs across the occupational spectrum in the very near future.[2] Because autonomous technologies are particularly apt to performing routine tasks, workers who hold "low-skill and low-wage" jobs are far more likely than their "high-skill and high-wage" counterparts to be substituted by automation.[3]

The working class will bear the brunt of the immediate social cost imposed by the next wave of technological advancement, as it has for centuries.[4] But the worker whose job was replaced by a machine has always persevered and found

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[1] *See* Zia Qureshi, *How Digital Transformation is Driving Economic Change*, BROOKINGS (Jan. 18, 2022), https://www.brookings.edu/blog/up-front/2022/01/18/how-digital-transformation-is-driving-economic-change/ [https://perma.cc/DSS8-J24J] (noting that digital transformation of the economy is leaving many behind "across industries and firms, the workforce, and different segments of society").

[2] *See* CONOR MCKAY, ETHAN POLLACK & ALASTAIR FITZPAYNE, AUTOMATION AND A CHANGING ECONOMY, PART I: THE CASE FOR ACTION 2 (2019).

[3] Carl Benedikt Frey & Michael A. Osborne, *The Future of Employment: How Susceptible Are Jobs to Computerisation?*, TECH. FORECASTING & SOC. CHANGE Sept. 29, 2016 at 254, 267 .

[4] *See* Katharine McGowan & Sean Geobey, *"Harmful to the Commonality": The Luddites, the Distributional Effects of Systems Change and the Challenge of Building a Just Society*, 18 SOC. ENTER. J. (2022) (discussing both the historical roots and contemporary status of the early 19th century's Luddite movement).

employment elsewhere.[5] The next wave of advancement in autonomous technologies, which will introduce systems characterized by artificial intelligence, machine learning, and advanced robotics, may well foreclose that possibility.

Autonomous technologies driven by artificial intelligence, machine learning, and advanced robotics will vastly increase the breadth of automatable jobs.[6] One influential study predicted that nearly half of all jobs in the United States will be automatable by 2040.[7] Jobs in certain employment sectors are especially likely to be automated away. Workers in the service, administrative, transportation, and farming sectors will be hit the hardest, as their jobs are most susceptible to full substitution by autonomous technologies.[8] For these workers, the future may be bleak. When autonomous technologies can fully substitute a worker, that worker will be unemployed while searching for a new job. But when autonomous technologies can fully substitute an entire profession, the substituted workers will outnumber the available jobs, and unemployment will become endemic. Workers whose livelihoods depend on overcoming such an obstacle must learn to complement, and thus coexist with, autonomous technologies.[9] But how?

To become complementary to autonomous technologies, humans must possess high cognitive skills, such as "creativity, critical thinking, decision making, and complex information processing."[10] Demand for the physical and manual skills of the typical worker will soon become largely obsolete.[11] While any person can obtain the high cognitive skills needed to complement autonomous technologies, doing so requires a significant amount of time, money, and family support.[12] Substituting unskilled labor for autonomous technologies will only grow in breadth in the coming years. In particular, the farming industry—historically characterized by reliance on manual labor,

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[5] *See, e.g., Cyrus McCormick: Mechanical Reaper*, LEMELSON-MIT, https://lemelson.mit.edu/resources/cyrus-mccormick [https://perma.cc/C3L3-5BQJ] (describing how people who once worked on farms transitioned to employment in fields like engineering and medicine).

[6] Harry J. Holzer, *Understanding the Impact of Automation on Workers, Jobs, and Wages*, THE BROOKINGS INST. (Jan. 19, 2022), https://www.brookings.edu/blog/up-front/2022/01/19/understanding-the-impact-of-automation-on-workers-jobs-and-wages/ [https://perma.cc/GQ75-ZHHN].

[7] Frey & Osborne, *supra* note 3, at 268.

[8] *Id.*; *see also* Holzer, *supra* note 6.

[9] *See* Holzer, *supra* note 6.

[10] Jacques Bughin, Eric Hazan, Susan Lund, Peter Dahlström, Anna Wiesinger & Amresh Subramaniam, *Skill Shift: Automation and the Future of the Workforce*, MCKINSEY GLOB. INST. (May 23, 2018), https://www.mckinsey.com/featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce [https://perma.cc/BSA9-AU8H].

[11] *See id.*

[12] *See Is College Worth it for Me?: How Adults Without Degrees Think About Going (Back) to School*, PUB. AGENDA 3 (Nov. 2013), https://files.eric.ed.gov/fulltext/ED547419.pdf [https://perma.cc/WK8N-J2RM] [hereinafter *College*] (finding the two primary concerns for most adults considering going back to school are taking on debt and balancing school with work and family obligations).

repetitive tasks, and a need for cost reduction—consists of thousands of jobs that are susceptible to automation.[13]

Mechanized farming market leaders have enthusiastically responded to this opportunity.[14] John Deere developed a fully autonomous tractor that became available to farmers at the end of 2022.[15] DJI, a prominent drone manufacturer, offers a flying farming operation that can automatically monitor and apply pesticides to fields.[16] Fendt's Xaver solution implements a swarm of small, cloud-controlled, seed planting robots that are ready for operation "around the clock."[17] Autonomous tractors and seed-planting robots are specific to the farming sector, but similar technologies exist that are tailorable to nearly any industry. Widespread replacement of human jobs by machines is no longer just a hypothetical possibility. It is real, and it is knocking on society's front door.

Policymakers need to support the workers who will be substituted by autonomous technologies.[18] Technological progress—manifested in autonomous technologies—makes people more innovative, productive, and richer, but it does so at the cost of increasing unemployment and wealth inequality.[19] For policymakers to do nothing as autonomous technologies perform the routine tasks that average workers depend on to survive, is to sign off on "a hollowing out of the middle class."[20] Such an approach to government is untenable and unacceptable. Whether we like it or not, autonomous technologies are going to change the world. As a policy matter, the worst thing we could possibly do is ignore them.[21]

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[13] Frey & Osborne, *supra* note 3, at 267 (classifying "Farming, Fishing, and Forestry" as a group of jobs at high risk of being automated).

[14] *See Global Autonomous Farm Equipment Market to Reach US$231.8 Billion by the Year 2030*, AGRIC. MONITOR WORLDWIDE (June 17, 2022), https://www.reportlinker.com/p05818534/Global-Autonomous-Farm-Equipment-Industry.html?utm_source=GNW [https://perma.cc/ETR4-PU97] [hereinafter *Global Autonomous*] (concluding that the global market for autonomous farm equipment, which was estimated at $79.5 billion in the year 2022, is projected to reach a revised size of $231.8 billion by 2030).

[15] *John Deere Reveals Fully Autonomous Tractor at CES 2022*, JOHN DEERE (Jan. 4, 2022), https://www.deere.com/en/news/all-news/autonomous-tractor-reveal/ [https://perma.cc/5WHE-6CBG] [hereinafter *John Deere*].

[16] Kayleigh Bateman, *3 Ways Autonomous Farming is Driving a New Era of Agriculture*, WORLD ECON. F. (Jan. 20, 2022), https://www.weforum.org/agenda/2022/01/autonomous-farming-tractors-agriculture/ [https://perma.cc/7ESQ-9ZJY].

[17] *Project Xaver: Research in the Field of Agricultural Robotics*, FENDT, https://www.fendt.com/int/xaver [https://perma.cc/8H3U-CCJ8].

[18] *See* Holzer, *supra* note 6.

[19] Klaus Prettner & Holger Strulik, *Innovation, Automation, and Inequality: Policy Challenges in the Race Against the Machine*, 116 J. MONETARY ECON. 249, 250 (2020).

[20] *Id.*

[21] Adam Saunders, *Technology's Impact on Growth and Employment*, BBVA: OPENMIND (2017), https://www.bbvaopenmind.com/en/articles/technology-s-impact-on-growth-and-employment/ [https://perma.cc/YNS8-A2RV].

This article explores how manual farm workers—who are especially likely to be substituted by autonomous technologies—lack opportunities to obtain the skills required to complement those technologies. This problem exists throughout the United States, and similar problems exist across various industries. However, for several reasons, this article focuses specifically on the Kansas farming industry. First, the Kansas agriculture industry possesses infrastructure characteristics that make it an excellent location to efficiently and effectively implement autonomous farming equipment. Second, because its public education system is tailored to its agricultural economic base, Kansas could enact policy initiatives to increase educational accessibility for farm workers displaced by autonomous farming equipment.[22] Third, many leading manufacturers in the mechanized farming equipment sector have a significant presence in Kansas, which opens the door for privatized reskilling of farm workers.[23] But despite this article's focus on Kansas, its findings can be generalized to the farming industries of other states—particularly Great Plains states.

In recent years, there has been increased focus among economists and public policy scholars regarding the impact of automation on unskilled workers. However, no scholarship has specifically focused on how state governments, by augmenting their existing infrastructures that are tailored to their specific economies, could come to the aid of unskilled workers who are displaced by autonomous technologies. This article is the first to explore such forms of potential aid specifically within Kansas.

Part II of this article discusses the history of mechanized farming equipment, the rapid development of fully autonomous farming technologies, and the impact of automation on workers. Part III of this article proposes and analyzes two potential responses to help cushion the blow of technological advance by reskilling farm workers in Kansas: formal education reskilling and privatized reskilling. This article analyzes and compares the attributes of the two solution categories, ultimately concluding that privatized reskilling is superior to formal education reskilling. Kansas can and should take action in the form of robust policy initiatives that will enable privatized reskilling of farm workers who are substituted by autonomous technologies.

II. BACKGROUND

The Industrial Revolution began in earnest over 200 years ago, and replacement of manual labor with machinery has been a social issue ever since. The lessons of the past are vital to understanding how society can implement

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[22] *See generally Agricultural Education*, KAN. DEP'T OF AGRIC., https://agriculture.ks.gov/divisions-programs/agricultural-marketing-advocacy-and-outreach-team/agricultural-education [https://perma.cc/3EBK-XD33] (compiling and explaining various agricultural education programs in the state of Kansas).

[23] *See Ag Equipment Manufacturing & Sales*, KAN. DEP'T OF AGRIC. (2022), https://agriculture.ks.gov/docs/default-source/ag-growth-summit/2022-growth-documents/2022-ag-equipment.pdf [https://perma.cc/E8MG-E746].

appropriate policy responses to support workers as technological advancement marches on. This section focuses on understanding the history of mechanized farming equipment, the rapid development of autonomous farming technologies, and the impact of automation on workers.

A. Brief History of Mechanized Farming Equipment

From a modern point of view, it is difficult to imagine the sheer extent of back-breaking labor once required to effectively run a farm. At the dawn of the Industrial Revolution, farm workers routinely labored six days a week, from sun up to sun down, just to keep their crops growing.[24] At certain points in the farming cycle, manual labor demands were even greater. For example, most farmers have only a small window—about ten days—in which to harvest their crop for an entire year.[25] Before the first mechanized farming equipment innovations, humans armed with sickles carried out the harvest, each of whom could arduously gather about half an acre of grain per day.[26]

Seeking to overcome the production constraints imposed by the human body's capacity, Cyrus McCormick, together with the enslaved and historically overlooked Jo Anderson,[27] invented the horse-drawn mechanical reaper—a machine that automatically cut, threshed, and bundled grain—in the 1830s.[28] In an early exhibition of the reaper, McCormick harvested six acres of grain in half a day, outracing the production of a human and sickle by a factor of more than twenty.[29] Some regard the mechanical reaper as the touchstone of the Industrial Revolution's agricultural application, but the desire to increase farming production efficiency via use of mechanized equipment generated a long line of technological innovations.[30] For example, the thresher, steel plow,[31] and

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[24] *See* Kathy Sawyer, *200 Years Ago – The 12-Hour Day, The 6-Day* Week, THE WASHINGTON Post (Dec. 25, 1977), https://www.washingtonpost.com/archive/politics/1977/12/25/200-years-ago-the-12-hour-day-the-6-day-week/8a0f3c78-b7a0-4db4-ac33-00649519d1eb/ [https://perma.cc/LQ3R-EUUH].

[25] Mason Adams, *Cyrus McCormick's Reaper: The Ag Industrial Revolution Began in Virginia's Shenandoah Valley*, BLUE RIDGE COUNTRY (Aug. 8, 2014, 11:59 AM), https://blueridgecountry.com/newsstand/magazine/mccormick-reaper/ [https://perma.cc/JP47-HUUP].

[26] *Id.*

[27] *See* Bonnie V. Winston, *Jo Anderson*, RICHMOND TIMES-DISPATCH (Feb. 5, 2013), https://richmond.com/jo-anderson/article_277b0072-700a-11e2-bb3d-001a4bcf6878.html [https://perma.cc/Z9F9-9A6Y] (describing the life of Jo Anderson, a slave on the McCormick family plantation, who was a major contributor to the design and creation of the mechanical reaper).

[28] *Cyrus McCormick: Mechanical Reaper*, *supra* note 5.

[29] *See* Adams, *supra* note 25.

[30] *Id.*

[31] Mary Bellis, *American Farm Machinery and Technology Changes from 1776-1990*, THOUGHTCO. (Feb. 6, 2021), https://www.thoughtco.com/american-farm-tech-development-4083328 [https://perma.cc/Y5RK-C9BY] (explaining how a threshing machine was patented and steel plows were manufactured in 1837).

combine[32] were invented contemporaneously with the mechanical reaper. Each of these inventions contributed to widespread increases in farming efficiency, with the number of labor-hours required to produce five acres of wheat dropping from 250 in 1830 to 75 in 1850.[33]

Mechanized farming equipment's evolution accelerated drastically with the integration of steam and combustion driven equipment in the late 1800s and early 1900s.[34] Over time, these technological advancements eliminated the long-standing constraint of reliance on animal power to perform work, and further increased labor efficiencies.[35] By 1940, sophisticated manufacturers were producing gas powered combines and tractors on a mass scale, rendering animal-powered mechanized equipment noncompetitive and obsolete.[36] An enormous market of tractor and combine manufacturers developed, making the machines readily available to even the average farmer.[37] Companies such as John Deere, Case, International Harvester, and New Holland competed fiercely for market share and invested heavily in product development.[38] Because of this heated competition, mechanized farm equipment grew rapidly in power, speed, and size.[39] By 1970, one farmer could supply approximately seventy people in the United States and abroad with food,[40] and the growth in capacity has continued into modern times. Today, combines can harvest twenty-five acres of wheat per hour,[41] and the average Kansas farmer produces enough food to feed more than 150 people.[42]

Society has benefitted greatly from widespread integration of technology. Machines replaced millions of farm workers during the 1900s, and those workers were able to contribute their labor elsewhere, creating economic benefits.[43] More Americans were able to apply their skills to fields like engineering,

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[32] Natasha Post, *History of the Combine Harvester*, THE DAILY BALE (Mar. 30, 2021), https://www.tractortransport.com/blog/history-of-the-combine-harvester/ [https://perma.cc/86YG-WBB6] (noting that Hiram Moore built and patented the first combine harvester in 1835).
[33] *Id.*
[34] *See* Bellis, *supra* note 31.
[35] *See id.*
[36] *See* Hans Binswanger, *Agricultural Mechanization: A Comparative Historical Perspective*, 1 WORLD BANK RSCH. OBSERVER 27, 30 (1986) (displaying data regarding the sources of farm power in the United States from 1870-1979).
[37] *See* Amelia Fogarty, *Five Ways the Tractor Changed American Farming*, SMITHSONIAN (Mar. 1, 2018), https://www.si.edu/stories/five-ways-tractor-changed-american-farming [https://perma.cc/EQK6-Q8D8].
[38] *See* Mary Herring, *Harvest Equipment: A Brief History of the Combine*, IRON SOLS. (May 24, 2020), https://ironsolutions.com/a-brief-history-of-the-combine/ [https://perma.cc/Q8DN-G2BX].
[39] *See* William J. White, *Economic History of Tractors in the United States*, ECON. HIST. ASS'N (Mar. 26, 2008), https://eh.net/encyclopedia/economic-history-of-tractors-in-the-united-states/ [https://perma.cc/VJD2-92C8] (describing how tractor manufacturers in the mid-1900s developed increasingly large tractors to supply farms that were growing in size).
[40] Bellis, *supra* note 31.
[41] Herring, *supra* note 38.
[42] Jim McLean, *'Get Big or Get Out' Farming Has Left Kansas Towns Struggling for Survival*, KCUR (Oct. 18, 2019, 7:09 AM), https://www.kcur.org/agriculture/2019-10-18/get-big-or-get-out-farming-has-left-kansas-towns-struggling-for-survival [https://perma.cc/3VDV-WSAM].
[43] White, *supra* note 39.

medicine, and the arts because of the efficiencies created by mechanized farming equipment.[44] But the Industrial Revolution's impact on farming has brought its share of detriments. Armed with mechanized equipment, one farmer today can cultivate land that once would have taken several families to manage.[45] Farms have thus grown rapidly in size, often through consolidation.[46] The resulting commoditized farming markets often fail to return breakeven prices, forcing farmers in control of large operations to take on debt as a means of continuing operation.[47] As displaced farmers have migrated to urban centers in search of work, small towns, especially in the Great Plains, struggle to survive.[48]

The story of Downs, Kansas—a town of roughly 800 people nestled thirty minutes west of Beloit—is illustrative. In the 1980s, Downs teemed with life. Local businesses thrived and the close-knit people of Downs looked out for and took an interest in their neighbors' lives.[49] Today, the majority of the storefronts on Downs' once-vibrant main drag are boarded up and empty.[50] The few remaining businesses rely on a population which has diminished by over a third since the good old days.[51] Downs' slow death is merely one example of a phenomenon that has affected hundreds, if not thousands, of small towns across the United States. To the extent one questions the harm small towns have experienced as a result of urban migration, the author encourages you to spend a weekend driving along any rural highway in the nation and exploring communities on the way. The stories of those who have remained in their longtime homes are nothing short of heartbreaking.

B. Rapid Development of Fully Autonomous Farming Technologies

Modern combines, tractors, and other pieces of mechanized farming equipment enable farmers to work remarkably efficiently, but some degree of human operation is still required.[52] Modern mechanized farming equipment has

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[44] *Cyrus McCormick: Mechanical Reaper*, *supra* note 5.
[45] White, *supra* note 39.
[46] *See* U.S. DEP'T AGRIC., *Farming and Farm Income*, ECON. RSCH. SERV., https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/farming-and-farm-income/ [https://perma.cc/9QAW-9NM6] (displaying data showing the roughly 400% increase in average farm size during the mid-1900s).
[47] McLean, *supra* note 42.
[48] White, *supra* note 39.
[49] *See* Corie Brown, *Rural Kansas Is Dying. I Drove 1,800 Miles to Find Out Why*, THE COUNTER (Apr. 26, 2018, 8:00 AM), https://thecounter.org/rural-kansas-depopulation-commodity-agriculture/ [https://perma.cc/F39R-VKPJ].
[50] *Id.*
[51] *Id.*
[52] *See* Eric Njuki, *A Look at Agricultural Productivity Growth in the United States, 1948-2017*, U.S. DEP'T AGRIC. (July 29, 2021), https://www.usda.gov/media/blog/2020/03/05/look-agricultural-productivity-growth-united-states-1948-2017 [https://perma.cc/A5QM-5FQH] (displaying data showing that despite a significant disparity between farm productivity and labor, some degree of labor is still necessary).

decreased labor costs rather than entirely eliminating them. Thus, most modern mechanized farming equipment can be classified as partially autonomous technology.[53] Distinct from partially autonomous technologies is fully autonomous technologies, machines that perform work without *any* human labor input.[54] Today, technological advancements have brought to the verge of feasibility development and widespread implementation of fully autonomous farming technologies.[55] The farming industry is responding enthusiastically to these developments, and fully autonomous farming technologies are projected to be widely integrated over the next few years.[56]

Demand for fully autonomous farming technologies is expanding rapidly, to the extent that the global market for such technologies, currently estimated at $79.5 billion, is expected to grow to $231.8 billion by 2030.[57] North America has been identified by key market participants as a leading regional market for adoption of fully autonomous farming technologies[58] because many of the inherent traits that making farming susceptible to automation are evident in North America—and particularly in the Great Plains states. For example, massive grasslands and wheat fields provide ideal opportunities for the adoption of fully autonomous tractors.[59] The enormous amounts of farmed land and wheat production in Kansas make it arguably more attractive for use of fully autonomous farming technologies than any other state. As of 2021, Kansas ranked behind only Montana and Texas in total farmed acreage—despite being significantly smaller than either.[60] Kansas produces more wheat than any other state, accounting for almost eighteen percent of all wheat grown in the United States.[61]

The massive grasslands and wheat fields of Kansas and other Great Plains states is one factor supporting the development of fully autonomous farming technologies. Another factor is the growth of innovative farming solutions that

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[53] *See Global Autonomous*, *supra* note 14.

[54] *See* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *Automated Vehicles for Safety*, U.S. DEP'T TRANSP., https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety [https://perma.cc/FZ6G-E6GF] (describing a standardized hierarchy of autonomous vehicles, which distinguishes between various levels of partial automation and full automation).

[55] James Lowenberg-DeBoer, Karl Behrendt, Melf-Hinrich Ehlers, Carl Dillon, Andreas Gabriel, Iona Yuelu Huang, Ian Kumwenda, Tyler Mark, Andreas Meyer-Aurich, Gabor Milics, Kehinde Oluseyi Olagunju, Søren Marcus Pedersen, Jordan Shockley, & David Rose, *Lessons to be Learned in Adoption of Autonomous Equipment for Field Crops*, 44 APPLIED ECON. PERSPS. & POL'Y 848, 850 (2021).

[56] *See* Frey & Osborne, *supra* note 3, at 268.

[57] *See Global Autonomous*, *supra* note 14.

[58] *See id.*

[59] Andrew Joseph, *Autonomous Tractor Usage to Reach Nearly 40,000 Units by 2026*, FARMS.COM (Mar. 24, 2022), https://m.farms.com/ag-industry-news/autonomous-tractor-usage-to-reach-nearly-40-000-units-by-2026-865.aspx.

[60] NAT'L AGRIC. STAT. SERV., *Farms and Land in Farms, 2021 Summary*, U.S. DEP'T AGRIC. (Feb. 2022), https://www.nass.usda.gov/Publications/Todays_Reports/reports/fnlo0222.pdf [https://perma.cc/5VTF-J7QK].

[61] Doug Bounds, *Kansas: A Leader in Wheat, Grain Sorghum, and Beef Production*, U.S. DEP'T AGRIC. (July 29, 2021), https://www.usda.gov/media/blog/2019/07/03/kansas-leader-wheat-grain-sorghum-and-beef-production [https://perma.cc/YW7D-PD6F].

use artificial intelligence, advanced robotics, and other powerful technologies. Artificial intelligence is driving many innovative machines because it enables precision farming, provides advanced solutions for ensuring timely harvesting, and enables use of predictive analytics for improving crop production quality.[62] Global Positioning Systems ("GPS") and auto-steering capabilities are being integrated into tractors and combines, allowing them to automatically leverage the capabilities of artificial intelligence, which will enable both autonomy and improved production.[63] John Deere has developed and is currently manufacturing an autonomous tractor that uses a GPS grid to continuously check its position while operating, and is accurate to within less than an inch.[64] The John Deere tractor can be started and configured from a mobile app, which gives farmers access to live video, images, data, and metrics. The app even allows farmers to adjust the speed and depth of the machine.[65]

C. The Impact of Automation on Farm Workers

Many say that in the long run, automation creates as many jobs as it displaces.[66] This may well be true, but long-term generalizations do little to solve the short-term hardships imposed on a person whose job is replaced by automation. Automation obviously creates jobs, but those jobs are available mostly to people who possess the skills required to complement autonomous technologies.[67] Workers who perform tasks similar to the automated technologies—and thus are directly substituted by them—are left jobless.[68] Automation generally shifts compensation from workers to business owners or directors, who enjoy higher profits with less need for labor.[69] In a capitalist system, this powerful profit incentive frequently justifies automation from an economic perspective, resulting in an endless desire to automate away more jobs

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[62] *See, e.g.*, Raviv Itzhaky, *Artificial Intelligence and Precision Farming: The Dawn of the Next Agricultural Revolution*, FORBES (Jan. 7, 2021), https://www.forbes.com/sites/forbestechcouncil/2021/01/07/artificial-intelligence-and-precision-farming-the-dawn-of-the-next-agricultural-revolution/?sh=48344a391dbe (describing how technologies driven by artificial intelligence allow farmers to optimize resource allocation and other efficiencies).

[63] *See, e.g.*, Hugo Claver, *Artificial Intelligence to Command Autonomous John Deere Machinery*, FUTURE FARMING (Nov. 10, 2022), https://www.futurefarming.com/tech-in-focus/autonomous-semi-autosteering-systems/artificial-intelligence-to-command-autonomous-john-deere-machinery/ (describing an artificial intelligence system that can command autonomous farming machinery).

[64] *John Deere*, *supra* note 15.

[65] *Id.*

[66] Holzer, *supra* note 6.

[67] *Id.*

[68] *See id.*

[69] *Id.*

that expands the scope of automation's detrimental short-term impact on workers.[70]

Economists have identified negative residual impacts of widespread automation. For example, one influential study examining these residual harms found that for every robot added per 1,000 workers in the United States, wages decline by 0.42 percent and the employment-to-population ratio decreases by 0.2 percent.[71] While each robot had a relatively minimal macroeconomic impact, the effect was significantly more severe within specific geographic areas where robots were deployed. The study concluded that for every robot deployed in a defined geographic area, local employment was reduced by six workers.[72] In many industries, robots displace more jobs than increase productivity.[73]

Although the study discussed above only investigated robotics, its findings can likely be generalized to any method of automation that can carry out duties traditionally accomplished via "routine manual occupations" performed by "lower- and middle- class workers."[74] Many of the duties performed by farm workers fall into this category.

Perhaps the most disturbing characteristic of autonomous technologies is that their applications, already extensive, are projected to grow rapidly in breadth in the near future.[75] Before long, virtually any occupation imaginable may be automated. Analysis of the future effect of automation includes a great deal of uncertainty.[76] But the negative impact of automation will, at least in the short-term, fall hardest on the manual laborers of the working class.[77] Policymakers must take action to mitigate the harms of inevitable technological advancement.

III. ADDRESSING THE PROBLEM

With widespread implementation of fully autonomous farming technologies on the horizon, Kansas should implement robust policy responses to counteract the negative impacts of such technologies on farm workers. To counteract those negative impacts, policymakers should focus on formal education reskilling and privatized reskilling.

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[70] *See* Alex Ortiz, How Automation is Changing the Face of Business, TRAY.IO, https://tray.io/blog/business-automation [https://perma.cc/L7BZ-XS7Q].
[71] Sara Brown, *A New Study Measures the Actual Impact of Robots on Jobs. It's Significant.*, MIT SLOAN SCH. OF MGMT. (July 29, 2020), https://mitsloan.mit.edu/ideas-made-to-matter/a-new-study-measures-actual-impact-robots-jobs-its-significant [https://perma.cc/64J3-AFSK].
[72] *Id.*
[73] *See id.*
[74] *See id.*
[75] *See* Holzer, *supra* note 6.
[76] Brown, *supra* note 71.
[77] *Id.*

A. Formal Education Reskilling

Fully autonomous farming technologies have the power to automatically perform the duties traditionally performed by farm workers, completely eliminating the need for any human labor. The overwhelming majority of farm workers will soon find themselves substituted by machines,[78] and will likely have few other employment options in the farming industry. The key to any effective policy response with a basis in formal education must be to teach displaced or displaceable workers new skills that will allow them to become complementary to autonomous technologies.[79] Kansas already possesses a public education system tailored to its agricultural economic base.[80] Kansas could implement policy initiatives that augment this system, taking advantage of its existing infrastructure to make education more accessible to farm workers displaced by autonomous technologies.

Primarily through its Department of Agriculture, Kansas has established several educational programs that aim to provide paths to careers in agriculture for young people.[81] One of Kansas's flagship universities consistently ranks among the nation's top ten schools of agriculture.[82] These educational programs make clear that Kansas values and has invested significantly in its agricultural economy. Yet in their current states, these programs fall well short of the mark in terms of preparing farm workers to complement fully autonomous farming technologies.

Unsurprisingly, the main thrust of Kansas's agricultural education programs is focused on young people.[83] Kansas deserves to be applauded for its focus on developing agricultural skills for the next generation of farmers, but the programs Kansas has enacted are not tailored to the needs of the average farm worker, the majority of whom are over thirty-five years old and lack high school

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[78] *See* Holzer, *supra* note 6.

[79] *Id.*

[80] *See* KAN. DEP'T OF AGRIC., *supra* note 22.

[81] *See* KAN. DEP'T OF AGRIC., *Kansas Agriculture Skills & Competencies Certificate*, https://agriculture.ks.gov/docs/default-source/ag-marketing/handout---general-kansas-ag-skills-and-competencies-certificate.pdf?sfvrsn=c91694c1_4 [https://perma.cc/S4SE-5EL9]; KAN. DEP'T OF AGRIC., *Kansas Animal Science Skills & Competencies Certificate*, https://agriculture.ks.gov/docs/default-source/ag-marketing/handout---kansas-animal-science-skills-and-competencies-certificate.pdf?sfvrsn=ca1694c1_4 [https://perma.cc/J5EK-XATP]; KAN. DEP'T OF AGRIC., *Kansas Plant Systems Skills & Competencies Certificate*, https://agriculture.ks.gov/docs/default-source/ag-marketing/handout---kansas-plant-systems-skills-and-competencies-certificate.pdf?sfvrsn=cd1694c1_4 [https://perma.cc/UGA8-R24X].

[82] *K-State College of Ag Nabs No. 6 in Latest Nich.com Rankings,* K-STATE RSCH. & EXTENSION (Sept. 15, 2023), https://www.ksre.k-state.edu/news/stories/2023/09/agriculture-niche-ranks-kstate-number-six.html [https://perma.cc/46RA-VJ57].

[83] *See* KAN. DEP'T OF AGRIC., *supra* note 22; KAN. STATE UNIV., *Outreach,* COLL. OF AGRIC., https://www.ag.k-state.edu/outreach/ [https://perma.cc/L8WD-NYGZ].

diplomas.[84] The average age of farm workers has risen steadily over the last fifteen years, climbing from thirty-six in 2006 to nearly forty in 2021.[85] Fewer young immigrants are entering the agricultural workforce, which has increased the average age of foreign-born farmworkers.[86] Because of this, the average age of the farm workforce in general has been driven up.[87]

Foreign workers are important to Kansas's agricultural industry and should be considered when formulating policy responses to the problems posed to farm workers by fully autonomous farming technologies. When considering options that might impact immigrant farmworkers, policymakers should analyze various concerns such as the transitory nature of the immigrant farming workforce, potential language barriers, and deeper issues regarding the United States' legal policy on handling documented and undocumented immigrants. The author proceeds under the assumption that any farm worker, regardless of age, wealth, gender, or immigration status, *could* proceed through an educational program designed to teach farm workers how to complement fully autonomous farming technologies.

Kansas could create a system of programs designed to teach farm workers how to complement fully autonomous farming technologies by expanding the existing adult basic education ("ABE") programs that currently exist in a broad network of Kansas community colleges.[88] Currently, Kansas's ABE Centers help lesser educated adults learn English as a second language, develop skills in reading, math, writing, social studies, and science, and upgrade job skills including critical thinking, digital literacy, and working with others.[89] This network, which stretches across Kansas, provides an existing infrastructure of accessible educational resources which could be used as a baseline to develop programs tailored to specific problems facing the lesser educated adult workforce—including many farm workers.

Development of fundamental skills facilitated by ABE programs in their current conditions could have significant value to many farm workers who find themselves substituted by fully autonomous farming technologies. However, ABE programs currently are not sufficient to set farm workers up for long term success. To acquire the critical thinking, decision making, and complex information processing skills needed to become complementary to autonomous

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[84] U.S. DEP'T OF AGRIC., *Farm Labor*, Table of Demographic Characteristics of U.S. Hired Farmworkers and All Wage and Salary Workers 2021, https://www.ers.usda.gov/topics/farm-economy/farm-labor/#demographic [https://perma.cc/V43H-R9SQ].

[85] U.S. DEP'T OF AGRIC., *Farm Labor*, Graph of Average Age of U.S. Farm Laborers/Graders/Sorters by Place of Birth 2006-21, https://www.ers.usda.gov/topics/farm-economy/farm-labor/#demographic [https://perma.cc/V43H-R9SQ].

[86] *Id.*

[87] *Id.*

[88] *See Adult Education Centers*, KAN. BD. OF REGENTS, https://www.kansasregents.org/academic_affairs/adult-education/adult-education-centers [https://perma.cc/D2TD-529L] (listing community colleges in Kansas that offer some form of adult basic education).

[89] *See Adult Education*, KAN. BD. OF REGENTS, https://www.kansasregents.org/adult_education#:~:text=In%20Kansas%2C%20Adult%20Education%20Centers,like%20manufacturing%20and%20health%20care. [https://perma.cc/58D9-B6NA].

technologies,[90] most farm workers would benefit greatly from transitional assistance from an ABE program to some form of postsecondary education.[91]

Postsecondary education need not be provided in the form of a traditional college degree. Indeed, it may be relatively impracticable to funnel many farm workers from ABE programs to four-year universities. Competence is not the question, but balance. Schooling requires significant time, money, and family support. For students who lack a substantial amount of financial savings, it is difficult to provide for one's self and family.[92] Unfortunately, with an average wage of just over $16.50 per hour,[93] the overwhelming majority of nonsupervisory farm workers likely lack the savings necessary to put themselves through a bachelor's degree program.

If a formal education program is to succeed in reskilling substituted farm workers with the capabilities required to complement fully autonomous farming technologies, it must be highly efficient. The program's curriculum should be tailored specifically to the vocations that are most likely to arise as a result of widespread implementation of fully autonomous farming technologies. Some of these vocations, such as machine learning programmer and business process automation programmer, require a degree of technical specialization that probably could not be achieved through a relatively efficient vocational program.[94] However, policy makers likely will find it quite feasible to develop vocational programs designed to provide participants with the skills needed to become, for example, an artificial intelligence trainer or a robot technician.[95]

Kansas has already developed a public Career and Technical Education ("CTE") program that embraces the benefits of vocational education programs and makes them broadly available—at least to young students.[96] Kansas's CTE system offers a diverse range of vocational education programs, covering

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[90] *See* Bughin et al., *supra* note 10.

[91] *See* JUDY ALAMPRESE, ABT ASSOCS., INC., HELPING ADULT LEARNERS MAKE THE TRANSITION TO POSTSECONDARY EDUCATION 4–10 (U.S. Dep't of Educ., 2005), https://www.abtassociates.com/files/Insights/reports/2005/transitionfnl110405.pdf [https://perma.cc/6RM7-F9AW].

[92] *See College*, *supra* note 12.

[93] U.S. DEP'T OF AGRIC., *Farm Labor*, Table of Average Wages by Occupation 2022, https://www.ers.usda.gov/topics/farm-economy/farm-labor/#demographic [https://perma.cc/V43H-R9SQ].

[94] *See Ten Future Jobs Already Here Thanks to Automation*, THINKAUTOMATION, https://www.thinkautomation.com/future-of-work/ten-future-jobs-already-here-thanks-to-automation/ [https://perma.cc/7RK2-N5PL].

[95] *See id.*

[96] *See* KAN. DEP'T OF EDUC., *Career and Technical Education (CTE),* https://www.ksde.org/Agency/Division-of-Learning-Services/Career-Standards-and-Assessment-Services/CSAS-Home/Career-Technical-Education-CTE [https://perma.cc/HP46-EGLN].

numerous science, technology, engineering, and mathematics subjects.[97] The CTE system operates by developing partnerships with employers and developing standards of curriculum that emphasize current industry standards and practices.[98] Many of the CTE "pathways" that currently exist in Kansas include curriculum which is highly relevant to the skills needed by farm workers who will be substituted by fully autonomous farming technologies in the coming years. For example, the engineering and applied mathematics pathway provides dedicated courses focusing on robotics, digital electronics, and emerging technologies, all useful in developing skills needed to effectively complement autonomous farming technologies.[99] Relevant CTE coursework exists with respect to agriculture careers as well. For example, the agriculture, food, and natural resources pathway provides dedicated courses focusing on agricultural mechanics, fabrication, power, and small engines.[100]

Such offerings are promising, but Kansas currently lacks a CTE program that specifically develops the skills necessary to succeed in vocations which directly complement fully autonomous farming technologies. To fix the problems posed to unskilled farm workers by the widespread implementation of such technologies, the Kansas Department of Education should engage in a two-prong policy response. First, the Department of Education should direct funding to the existing ABE network, empowering local community colleges to engage in outreach programs that market the availability of their basic educational programs to unskilled farm workers in need of such education. A portion of this funding should also be used to increase the resources available to provide ABE curriculum in the event of an enrollment influx. Second, the Department of Education should develop and offer a dedicated CTE pathway which will provide unskilled farm workers with a formal, postsecondary means of acquiring the skills needed to work alongside fully autonomous farming technologies.

Such a response would be relatively easy to implement, logistically speaking, because of the existing educational infrastructure in Kansas. Kansas already places a unique emphasis on providing education opportunities related to agricultural technologies—this potential response simply extends those educational opportunities to a class of Kansans who otherwise may not have access to them.

However, a number of potential issues could cloud the effectiveness of this response. For example, widespread implementation of fully autonomous farming technologies is a pressing issue that will likely cause significant worker

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[97] *See KAN. DEP'T OF EDUC., Career and Technical Education (CTE), https://www.ksde.org/Agency/Division-of-Learning-Services/Career-Standards-and-Assessment-Services/CSAS-Home/Career-Technical-Education-CTE [https://perma.cc/HP46-EGLN].*

[98] *Id.*

[99] *See* KAN. DEP'T OF EDUC., *Engineering and Applied Mathematics Pathway*, https://www.ksde.org/LinkClick.aspx?fileticket=G6Hi4Y21NO8%3d&tabid=1091&portalid=0&mid=3287 [https://perma.cc/9KBX-WY8M].

[100] KAN. DEP'T OF EDUC., *Agriculture, Food & Natural Resources Career Cluster Design*, https://www.ksde.org/LinkClick.aspx?fileticket=crgazyVa_wg%3d&tabid=449&portalid=0&mid=1559 [https://perma.cc/T5KB-VK38].

displacement within the next few years. The educational curriculum this response requires involves extensive details and will take time to develop. It will be difficult to enact the program quickly and proactively. In addition, the Kansas Department of Education would bear the onus of funding the program, and financial costs could limit the scope and effectiveness of this policy initiative.

Kansas has an existing infrastructure that provides an intriguing opportunity for a formal education reskilling policy response that provides opportunities for unskilled farm workers to gain skills necessary to complement autonomous technologies. However, policymakers face significant potential drawbacks in this response, and standing alone, this policy response is suboptimal.

B. Privatized Reskilling

Kansas already has a well-developed mechanized farming equipment sector.[101] The market for fully autonomous farming equipment is projected to grow expansively in the coming years.[102] As market forces drive the proliferation of fully autonomous farming technologies, many farm workers will be substituted by machines.[103] Policymakers should consider connecting substituted farm workers with reskilling opportunities provided by the private market (i.e., manufacturers of fully autonomous equipment). Kansas could implement policies which encourage private market participants to develop and administer programs that reskill farm workers, significantly mitigating the harms faced by many of those workers.

Because of how important farming is to Kansas's economy, the private market for mechanized farming equipment is already well-developed. Many leading manufacturers in the mechanized farming equipment sector have a significant presence in Kansas. AGCO has its top North American facility for manufacturing implements and combines in Hesston, Kansas.[104] Great Plains Manufacturing, a leading manufacturer of agricultural implements for tillage, seeding, and planting in the United States, is headquartered in Salina, KS.[105] These are only two examples of a statewide industry which was valued at $4.2

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[101] *See* KAN. DEP'T OF AGRIC., *supra* note 23.
[102] *See Global Autonomous*, *supra* note 14.
[103] *See* Holzer, *supra* note 6.
[104] *Hesston by Massey Ferguson® Marks 75th Anniversary*, AGCO: NEWS RELEASES (Feb. 9, 2022), https://news.agcocorp.com/2022-02-09-Hesston-by-Massey-Ferguson-R-Marks-75th-Anniversary [https://perma.cc/H3ST-BE39].
[105] *See* Charles Rankin, *Great Plains Continues to Expand Thanks to 45 Years of 'Central Kansas Work Ethic'*, SALINA J. (Mar. 28, 2021, 7:00 AM), https://www.salina.com/story/news/2021/03/28/great-plains-manufacturing-celebrates-45-years-success-salina-roy-applequist/6996450002/ [https://perma.cc/GQ22-5L4L].

billion in 2022.[106] Because of state policies that tend to promote agricultural development, Kansas is a promising location for farming equipment manufacturers who are interested in expansion.[107]

Unsurprisingly, many private market participants in the mechanized farming equipment sector have invested heavily in developing fully autonomous farming equipment.[108] As product development and technological advancement increase, one can assume that many mechanized farming equipment market participants will soon manufacture fully autonomous farming equipment. But manufacturers will be able to produce and sell fully autonomous farming equipment only if their employees have the skills necessary to work alongside the new technologies.

Private market participants—including manufacturers of fully autonomous farming equipment—always have a significant interest in building an engaged, skilled workforce.[109] Private market participants who lack employees with appropriate skills cannot maximize growth and respond to opportunities.[110] As empirical evidence has shown, private market participants can no longer rely on the education system alone to provide workers who possess skill sets tailored to their specific needs.[111] For example, one prominent pollster found that only eleven percent of business leaders strongly agree that college graduates are well-prepared for success in the workplace.[112] Private market participants know what they want, and the public education system is not delivering. This phenomenon has been widely researched, and is referred to here as the "skills gap."[113]

The gap between skills private employers desire and skills public education systems emphasize is a complicated issue. Broadly speaking, though, private sector collaboration with educational institutions, not-for-profits, and government organizations is likely the most effective means of bridging the skills gap.[114] Business leaders increasingly see investing in training and reskilling workers as an urgent business priority.[115] The accelerating pace of

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[106] KAN. DEP'T OF AGRIC., *supra* note 23.
[107] *Id.*
[108] *See Manufacturers of Autonomous Farm Machinery*, FARM EQUIP. (Dec. 17, 2022), https://www.farm-equipment.com/articles/21001-manufacturers-of-autonomous-farm-machinery [https://perma.cc/UU2U-U4ZG] (listing some of the fully autonomous technologies currently in development by manufacturers such as AGCO, John Deere, and New Holland).
[109] *See* Ilya Bonic, *Three Ways the Private Sector is Filling Skills and Training Gaps*, WORLD ECON. F. (June 19, 2015), https://www.weforum.org/agenda/2015/06/3-ways-the-private-sector-is-filling-skills-and-training-gaps/ [https://perma.cc/9M7W-7UR3].
[110] *See id.*
[111] *Id.*
[112] Brandon Busteed, *Higher Education's Work Preparation Paradox*, GALLUP NEWS (Feb. 25, 2014), https://news.gallup.com/opinion/gallup/173249/higher-education-work-preparation-paradox.aspx [https://perma.cc/8TGD-ERG3].
[113] *See* Bonic, *supra* note 109.
[114] *Id.*
[115] Pablo Illanes, Susan Lund, Mona Mourshed, Scott Rutherford, and Magnus Tyreman, *Retraining and Reskilling Workers in the Age of Automation*, MCKINSEY GLOB. INST. (Jan. 22, 2018), https://www.mckinsey.com/featured-insights/future-of-work/retraining-and-reskilling-workers-in-the-age-of-automation [https://perma.cc/4PF9-DUW7].

enterprise-wide transformation drives this sense of urgency.[116] For manufacturers of mechanized farming equipment who will soon transform their enterprises to integrate fully autonomous technologies, the urgency of training and reskilling workers is plainly evident.

Mechanized farming equipment manufacturers will need to transform their manufacturing and service divisions to integrate fully autonomous technologies. Because of the ongoing skills gap phenomenon, manufacturers of fully autonomous farming equipment will face a shortage of skilled workers. The pool of unskilled farm workers will grow as fully autonomous farming equipment is deployed.[117] Kansas would effectively address two pressing issues simultaneously by developing policies that connect displaced farm workers with employers in need of appropriately skilled workers.

Kansas should seek to take advantage of its farming industry's pressing need to train and reskill workers. Private market participants—such as manufacturers of fully autonomous farming equipment—generally know what skills workers need to add value to their businesses. By transferring much of the risk associated with reskilling to private market participants, Kansas could leverage the strong risk-management capabilities of the private sector.[118]

Kansas could incentivize manufacturers of fully autonomous farming equipment to develop and administer programs that reskill substituted farm workers by offering a state income tax credit. This policy response would be similar to the Work Opportunity Tax Credit ("WOTC") program—a federal tax credit available to employers who "invest in American job seekers who have consistently faced barriers to employment."[119] The WOTC program currently offers income tax credits only when members of certain eligible employee groups are hired.[120] These groups include individuals who have completed or are completing vocational rehabilitation programs, individuals receiving Supplemental Security Income, and individuals who were unemployed and

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[116] Pablo Illanes, Susan Lund, Mona Mourshed, Scott Rutherford, and Magnus Tyreman, *Retraining and Reskilling Workers in the Age of Automation*, MCKINSEY GLOB. INST. (Jan. 22, 2018), https://www.mckinsey.com/featured-insights/future-of-work/retraining-and-reskilling-workers-in-the-age-of-automation [https://perma.cc/4PF9-DUW7].

[117] *See* Holzer, *supra* note 6.

[118] *See* Frank Beckers & Uwe Stegemann, *A Smarter Way to Think About Public-Private Partnerships*, MCKINSEY GLOB. INST. (Sept. 10, 2021), https://www.mckinsey.com/capabilities/risk-and-resilience/our-insights/a-smarter-way-to-think-about-public-private-partnerships [https://perma.cc/97AM-Z9D8].

[119] U.S. DEP'T OF LAB., *Work Opportunity Tax Credit*, https://www.dol.gov/agencies/eta/wotc [https://perma.cc/49CU-8DTE].

[120] *Federal and State Hiring Credits*, MOSS ADAMS LLP, https://www.mossadams.com/services/accounting/tax/credits-and-incentives/federal-and-state-hiring-credits [https://perma.cc/E69T-43P6].

received state or federal unemployment compensation for at least twenty-seven consecutive weeks.[121]

The WOTC program offers federal tax credits distributed at the state level.[122] However, states can (and do) go further, offering their own tax credit opportunities similar to those of the WOTC program.[123] New York, for example, offers a state franchise tax credit in exchange for employing certain classes of disabled people.[124] Illinois offers a state income tax credit in exchange for hiring qualified persons with criminal records.[125] Kansas could offer a state income tax credit to employers who develop and administer programs that reskill farm workers who are substituted by fully autonomous farming equipment.

If Kansas offered this tax credit, this policy response could unleash the efficiencies and knowledge inherent in the private market. Kansas already has a significant network of manufacturers who will be active in the fully autonomous farming equipment market, so demand for appropriately skilled workers within Kansas's borders will likely be met. Many substituted farm workers will likely be familiar with their local manufacturers of fully autonomous farming equipment. The familiarity and locality of privatized reskilling programs would likely make them more attractive to displaced workers than alternative responses with a basis in formal education. Manufacturers of fully autonomous farming equipment should know exactly what skills their workers need to be successful. A response which entrusts these highly knowledgeable parties to lead the charge is far more likely to provide efficient and effective reskilling than an alternative approach with its basis in formal, classroom-like education.

However, this response is not without its drawbacks. While offering a financial incentive may be the only way to get private market participants to develop and administer reskilling programs to displaced farm workers, a tax credit program may fall short of the mark. Different manufacturers will inevitably develop reskilling programs with different costs, and it might be difficult to accommodate these varying costs with a singular tax credit program. Manufacturers of fully autonomous farming equipment will almost certainly prefer to direct their efforts towards reskilling their existing employees, as opposed to unskilled farm workers. Balancing the needs of the general public with those of private entities and their longstanding employees is no easy task, and will likely create tension. Private market participants may be hesitant to

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[121] *Federal and State Hiring Credits, MOSS ADAMS LLP, https://www.mossadams.com/services/accounting/tax/credits-and-incentives/federal-and-state-hiring-credits [https://perma.cc/E69T-43P6].*

[122] *Id.*

[123] *Id.*

[124] *See* N.Y. DEP'T OF TAX'N & FIN., *Credit for Employment of Persons with Disabilities*, https://www.tax.ny.gov/pit/credits/disabilities.htm#:~:text=How%20much%20is%20the%20credit,%242%2C100%20per%20employee%20is%20available [https://perma.cc/P6HA-C455].

[125] LANER MUCHIN, LTD., *New Illinois Law Gives Employers Incentives to Hire Ex-Offenders and Allows Ex-Offenders to Seal Criminal Records*, JD SUPRA (Aug. 23, 2013), https://www.jdsupra.com/legalnews/new-illinois-law-gives-employers-incenti-49068/ [https://perma.cc/584V-SXK9].

even take a large tax credit because the profits associated with manufacturing fully autonomous farming equipment may be too great.

Despite these possible drawbacks, the efficiencies offered by a partnership between the Kansas government and its network of farming equipment manufacturers make it a particularly appealing policy response. In Kansas, manual farm workers will be substituted by fully autonomous farming equipment in a matter of years. Because of their deep knowledge of the relevant markets, manufacturers of fully autonomous equipment are especially apt to reskilling substituted workers to effectively complement fully autonomous technologies. Manufacturers of fully autonomous equipment, having undergone enterprise-level transformations of their own, will presumably be in need of workers eager to learn new skills. By offering a financial incentive to these private market participants, Kansas would facilitate a mutually beneficial program that directly connects substituted workers in need of reskilling to the parties most able to carry out the reskilling.

IV. CONCLUSION

As autonomous technologies replace traditional jobs, workers must fundamentally alter their skill sets to complement autonomous technologies. Privatized reskilling is superior to formal education reskilling for the farming industry in Kansas. But the issues farm workers in Kansas face can be generalized across the nation, to nearly any industry imaginable. Policymakers must take action to address reskilling, given the enormous scope of the need. Autonomous technologies are going to change the world, and policymakers cannot merely sit back and allow autonomous technologies to leave workers behind.